

WHAT IS CLAIMED IS:

- 1 1. A method of accessing and operating upon heterogeneous data at a plurality of
2 nodes comprising the steps of:
- 3 (1) propounding a request containing a data source object name
4 wherein the heterogeneous data is treated as a single data source object, said
5 *B* request further containing at least ^{as first} ~~one~~ method to be performed on the data
6 source object and at least a second method to be performed on the results
7 produced by performance of the first method;
- 8 (2) determining whether the data source object is distributed across
9 a plurality of nodes; and
- 10 (3) making a determination as to whether said second method
11 should be performed on said results at each respective node or should be
12 performed at the user site after said results are transmitted from each node
13 back to the user site.
- 1 2. The method of Claim 1 wherein, if it is determined that the data source object
2 is distributed, and said second method should be performed at the respective nodes,
3 the request is broken into a plurality of new requests, each of said new requests
4 including code representing said first and second methods and having a format
5 appropriate to one of the respective nodes where the data source object resides.
- 1 3. The method of Claim 2 further comprising the steps of:
2 transmitting said new requests to said nodes;
3 executing the first method concurrently on the data source object at the
4 corresponding nodes;
5 temporarily storing the results of execution of the first method; and
6 executing the second method on said results, said step of executing
7 being performed at each of said nodes where the data source object resides.

1 4. The method of Claim 1 wherein a first agent process at the user site performs
2 the step of making a determination as to whether the second method should be
3 performed at each respective node.

1 5. The method of Claim 4 wherein, in performing the step of determining
2 whether the data source object is distributed, the first agent process consults a data
3 source descriptor file containing a subset of data contained in a first repository of
4 metadata.

1 6. The method of Claim 5 wherein a remote agent process automatically executes
2 said first method, automatically stores the results produced by executing said first
3 method, and automatically executes said second method on said results.

1 7. The method of Claim 6 wherein the results of execution of said second method
2 are automatically returned to ~~a~~ the user site and, automatically merged by said first
3 agent process, and wherein a third method is then automatically executed on the
4 merged results by ~~a~~ said first agent process.

1 8. The method of Claim 7 wherein said first, second and third methods
2 respectively comprise a search of the data object, a sort of the results of the search,
3 and an e-mail of the merged results of the search.

1 9. The method of Claim 5 wherein the data source descriptor file is created from
2 the repository at run-time.

1 10. The method of Claim ⁴~~3~~ wherein a first messenger process cooperates with said
2 first agent process to transmit each said new request to its respective node.

1 11. The method of Claim 10 wherein said request is in the form of a script and
2 each said new request is in the form of a script having said format.

1 12. The method of Claim 11 wherein said script and said new scripts are each in
2 the form of a Java script.

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- 1 13. The method of Claim 11 wherein each of said nodes has associated therewith a
2 respective database, and a respective agent process, each respective agent process
3 comprising code selected to execute the respective new script with respect to the data
4 source object as it is contained in the respective database.
- 1 14. The method of Claim 13 wherein each of said databases is different from the
2 remaining respective databases.
- 1 15. The method of Claim 14 wherein the respective databases comprise at least
2 two databases, each selected from the following group: Oracle database, NT database
3 and SQL Server.
- 1 16. The method of Claim 13 wherein each respective agent process accesses
2 metadata located at the respective node in the course of executing the respective new
3 script at that node.
- 1 17. The method of Claim 16 wherein a data source descriptor file is created from
2 the metadata at each respective node for use by the respective agent process.
- 1 18. The method of Claim 16 wherein the metadata comprises a collection of data
2 source objects which reflect treatment of data stored in each respective database as a
3 single object and wherein each of said data source objects is broken down into
4 successive class levels.
- 1 19. The method of Claim 18 wherein said class levels include a class comprising a
2 System Node, System Server, Data Source Object, Field Desc and System Script.
- 1 20. The apparatus comprising:
2 a plurality of databases, each located at a different node,
3 data processing apparatus at each node, each data processing apparatus including an
4 agent code module, each agent code module being constructed to determine whether a
5 data source object presented in a script is distributed across a plurality of said nodes,
6 and if said object is distributed, to break the script into a plurality of new scripts

7 suitable for execution at a respective one of said nodes, and if the script contains a
8 plurality of successive methods, to determine whether a second of said methods
9 should be performed at the respective node on the results of execution of a first of said
10 methods at said respective node

1 21. The apparatus of Claim 20 further including a messenger code module at each
2 node for facilitating transmission of each of said new scripts to its respective node.

1 22. The apparatus of Claim 20 where each said agent code module is responsive to
2 said script to extract the data corresponding to said data source object from said
3 database and to execute a method contained in said script on said data.

1 23. The apparatus of Claim 22 further including a repository of metadata at each
2 said node, said metadata describing the contents of the data source objects available at
3 that node.

1 24. The apparatus of Claim 22 further including a repository application at each
2 node for creating a data source descriptor file for use by the agent in extracting data
3 from the database at that node.

1 25. An article of manufacture comprising:

2 a computer usable medium having computer readable program code
3 means embodied in said medium for accessing and executing a plurality of methods
4 on data at each of a plurality of nodes, said data being treated as a single data source
5 object, the computer readable code means comprising:

6 means for receiving a request containing a data source object name
7 wherein heterogeneous data is treated as a single data source object, said request
8 further containing a plurality of methods to be performed on the data source object;
9 and

10 means for determining whether to execute a second method contained
11 in one of said new requests at a first of said nodes upon the results of execution of a
12 first of said methods at said first node.

1 26. The article of Claim 25 further including means for determining whether the
2 data source object is distributed across a plurality of nodes; and if the data source
3 object is determined to be distributed, breaking the request into a plurality of new
4 requests, each of said new requests including code representing said second method if
5 said means for determining determines that said second method should be executed at
6 each of said plurality of nodes, each new request having a format appropriate for
7 execution at a respective one of said plurality of nodes.

1 27. The article of Claim 26 wherein said computer readable code means further
2 contains means for automatically executing said first method, automatically storing
3 the results of the execution, and then automatically executing said second method
4 upon the stored results and returning the results of execution of said second method to
5 a site which transmitted said request.

1 28. The article of Claim 25 wherein said computer readable code means further
2 includes means for automatically executing a third method included in a said request
3 on the returned results.

1 29. A data processing apparatus comprising:
2 means at a user node for receiving a request containing a data source object
3 name wherein heterogeneous data located at a plurality of remote nodes is treated as a
4 single data source object, said request further containing a first method to be
5 performed on the data source object at each of the nodes where said data source
6 object resides and a second method to be performed on the results of performing the
7 first method on the data source object; and
8 means for determining whether to execute said second method at each
9 of the remote nodes where said data source object resides or at said user node.

1 30. An article of manufacture comprising:
2 a computer usable medium having computer readable program code
3 means embodied in said medium, the computer readable code means comprising:

4 means for receiving a request containing a data source object name
5 wherein heterogeneous data is treated as a single data source object, said request
6 further containing a plurality of methods, a first of said methods to be performed on
7 the data source object; and

8 means for determining whether the data source object is distributed
9 across a plurality of nodes, and if so, for determining whether to execute a second of
10 said methods at each of the nodes where the data source object resides upon the results
11 of execution of a said first of said methods.

1 31. The article of Claim 30 wherein said code means further comprises means for
2 generating a plurality of new requests suitable for execution at the nodes where the
3 data object resides and containing the methods to be executed there.

1 32. The article of Claim 30 wherein said means for determining further determines
2 whether the data is stored locally or is nondistributed but stored remotely and means
3 responsive to either further determination to extract the data and execute said first
4 method upon the data.

1 33. The article of Claim 30 wherein said computer readable code includes an agent
2 process which performs the function of determining, and which consults a data source
3 descriptor file containing a subset of data contained in a first repository of metadata.

1 34. Computer executable process steps operative to control a computer and stored
2 on a computer readable medium, comprising:

3 a step to receive a request containing a data source object name
4 wherein heterogeneous data stored at a plurality of nodes is treated as a single data
5 source object, said request further containing a first method to be performed on the
6 data source object and a second method to be performed on the results produced by
7 performance of said first method;

8 a step to determine whether the data source object is distributed across
9 a plurality of remote nodes; and

10 a step wherein, if the data source object is determined to be distributed,
11 a determination is made as to whether each of said first and second methods should be
12 performed at the plurality of remote nodes.

1 35. The process steps of Claim 34 further including:

2 a step wherein, if it is determined that the data source object is
3 distributed and that said first and second methods should be performed at the remote
4 nodes, said request is broken into a plurality of new requests, each containing code
5 representing said first and second methods.

1 36. The process steps of Claim 34 further including a step to return results of
2 execution of said second method back to a location where said request originated.

b1 37. The process steps of Claim ³⁶~~34~~ including a step to merge results received at
2 said location and a step to execute a third method on those results.

1 38. The process steps of Claim 43 wherein said first, second and third methods
2 respectively are search, sort and e-mail.

39. A method of accessing and operating upon data in a system wherein the data to be accessed is stored at one or more nodes, said nodes including a user site, and a plurality of remote nodes the method comprising the steps of:

(1) inputting a script at the user site, the script containing a data source object name, said script further containing a plurality of methods, at least one method to be performed on the data source object and one or more additional methods each to be successively performed on the results of the preceding method; and

9 (2) executing said first method on the data source object at each
10 node where it resides, and automatically executing each additional method on
11 the results of execution of the preceding method.

1 40. The method of Claim 39 wherein said step (2) of executing comprises:

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- 2 (3) interpreting said script so as to generate a plurality of new
3 scripts, each new script being appropriate for execution at a respective one of
4 said nodes;
- 5 (4) transmitting said new scripts in parallel to each of their
6 respective nodes; and
- 7 (5) automatically executing at least one of said plurality of methods
8 in parallel at the said respective nodes on the results of executing a preceding
9 one of said methods at said respective nodes.
- 1 41. The method of Claim 40 further comprising the step of automatically returning
2 the results of executing said at least one method to said user site.
42. A method of accessing and operating upon data in a system wherein the data to
be accessed is stored at one or more nodes, said nodes including a user site, and a
plurality of remote nodes the method comprising the steps of:
- (1) inputting a script at the user site, the script containing a data
source object name, said script further containing a plurality of methods, at
least one method to be performed on the data source object and one or more
additional methods, each additional method to be successively performed on
the results of the preceding method;
- (2) executing said first method on the data source object at each
node where it resides; and
- (3) pipelining the results of executing said first method to said
second method for execution of said second method thereon.
43. The method of Claim 42 wherein said step of pipelining comprises storing said
results at each node where the data source object resides for execution at that
respective mode.